



Preoperative body-related emotional distress and culture as predictors of outcomes of bariatric surgery

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Received: 12 October 2020 / Accepted: 27 November 2020 / Published online: 3 January 2021
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Abstract

Purpose Findings concerning the impact of bariatric surgical intervention on both psychological variables and weight loss are often controversial and misconstrued the world over. The aim of this study was to classify bariatric surgery patients according to patterns of preoperative measures that may predict postoperative psychological and physiological outcomes and to compare these patterns between two distinct cultures.

Methods Of 169 consecutive bariatric surgery candidates from Israel and 81 candidates from the United States, 73 and 35 patients, respectively consented to be included in a follow-up phase. Body image dissatisfaction, emotional eating behaviors, risk of suicide, depressive symptoms, anxious symptoms, and percent excess weight loss were measured. *K*-means clustering procedure was used to classify bariatric surgery patients according to their preoperative body-related emotional distress, which was composed of body image dissatisfaction and emotional eating. The joint effect of culture and body-related emotional distress cluster on psychological distress was tested.

Results The cluster analysis revealed two preoperative body-related emotional distress patterns: high body-related emotional distress and low body-related emotional distress. Following surgery, US patients showed a higher risk of suicide and lower excess weight loss than Israeli patients within only the high body-related emotional distress cluster (a significant interaction effect).

Conclusion Preoperative assessment of body-related emotional distress patterns among bariatric surgery candidates may enable professionals to identify potential postoperative risks of suicide, anxiety, and decreased weight loss. The relationship between the body-related emotional distress cluster and outcome measures is culture dependent.

Level III Case–control analytic study.

Keywords Bariatric surgery · Body image dissatisfaction · Emotion dysregulation · Emotional eating · Cross-cultural differences · Psychological distress

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Introduction

Growing evidence of the benefits of bariatric surgery has contributed to its increased use over the last decade [1]. There is a general consensus regarding the direct influence of bariatric surgery on weight loss and obesity-related physical comorbidities among morbid obese patients (body mass index [BMI] ≥ 40 or ≥ 35). However, despite the merits of the surgery for reducing food intake, there are controversial findings concerning the impact of the surgical intervention on psychological variables such as depression, distress, risk of suicide, and anxiety [2, 3]. There is even evidence that, in some cases, there is a postoperative increase in these variables [4–6]. The reasons for this are not fully understood but likely involve physiologic processes, behavioral factors, and psychological characteristics. Several studies have suggested that preoperative psychological status is associated with suboptimal weight loss and/or postoperative psychosocial distress [7]. It is thus important to identify preoperative psychological factors that may be associated with postoperative outcomes to expand evidence-based management practices for patients and to optimize the surgery outcome [8, 9].

Contemporary psychological theory suggests that it may be shared features across diagnoses rather than a discrete diagnosis that better characterize and describe changes in psychosocial distress after bariatric surgery [8]. One of the goals of the present study is to identify these shared features. Recent studies on postoperative distress have depicted high preoperative levels of body image dissatisfaction (BID), namely, negative thoughts, beliefs, and feelings, about one's body [10], associated with the increased risk of psychological distress among bariatric surgery patients [11, 12]. The theoretical model of obesity known as the Circle of Discontent (COD) [13] highlights the important role of BID and its related negative effects, patterns of increased food intake, and heightened weight status in forming a vicious circle. This circular interaction disturbs the stability of the system that controls weight gain. High BID is known to be associated with weight-related stigma and overt discrimination [11] and is considered a major factor in driving the choice of bariatric surgery among ~ 30% of individuals with obesity [14] and influencing weight loss outcome after surgery [12]. Greater preoperative BID has been shown to predict psychological distress for one year following surgery [15].

BID tends to be associated with the inability to detect and describe physiological cues associated with emotional distress, thus leading individuals to experience stronger levels of emotional distress [16]. When under stress, an individual with BID may be more detached from their body and, therefore, more willing to engage in behaviors that may physically harm it [17], particularly if those

behaviors result in a positive consequence such as the experience of relief. One such behavior is emotional eating, namely, a tendency to overeat in response to negative emotions rather than hunger [18–20]. Emotional eating is an example of dysregulated behavior that was found related to symptoms such as anxiety, depression, and suicidal ideation and behavior [21]. Recently it was also identified as a mediator in the positive association between the preoperative BID and psychological distress among bariatric surgery candidates [22]. In particular, high endorsement of emotional eating prior to bariatric surgery predicted less weight loss one year after surgery [23].

Since BID is a key negative affect related to emotional eating, we argue that a combination of BID as a psychosocial factor and emotional eating may yield a unique measure of body-related emotional distress (BED) that could better identify psychological distress changes following surgery. Profiling bariatric surgery patients based on preoperative BED and grouping them in clusters may help to identify the group of patients that might best benefit from the surgical process or need a specifically tailored intervention to profit from the process. A clarification of the association between a patient's profile and surgery outcomes (both psychological and physiological) may help explain why some patients with obesity experience psychological consequences due to their condition while others do not [24].

Furthermore, this study argues that the proposed combined measure of BED is culture dependent, as both emotional eating [25] and attitudes toward the body [26, 27] have been proved to be influenced socially and culturally. Understanding the similarities and discrepancies between cultures in the association between preoperative cluster assignment and its impact on psychological and physiological outcomes could contribute to the purpose of personalized medicine and psychological interventions both pre- and post-surgery. This study chose, therefore, to compare Israel and the United States.

Israel is a culturally and religiously heterogeneous westernized country whose lifestyle is also considered traditional [28, 29]. This has implications for the study of obesity in general and BID in particular, as it has been suggested that Israeli cultural and religious norms promote healthier attitudes toward the body [30] and a strong association between food and social familial affection and support [31]. Nevertheless, there is also some evidence that many of Israeli society's protective features over body image have been eroded with the country's growing westernization [32], and both Israel and the United States are examples of industrialized western nations where body fat is considered bad and there is pervasive stigmatization of overweight and obese individuals [33, 34]. Regarding food and its role, US culture, renowned for being individualistic [35] is characterized by individualistic eating and food worrying [36].

Table 1 Comparison between sample characteristics of US and Israeli participants (data presented as *M* [SD] or *N* [%])

	US	Israel	F/Chi-square	<i>p</i>
Gender			4.8	0.028
Female	30 (83%)	41 (67%)		
Male	5 (17%)	22 (23%)		
Age	46.4 (10.2)	44.6 (12.1)	0.6	0.448
Higher education			5.5	0.019
Yes	22 (65%)	25 (40%)		
No	12 (35%)	38 (60%)		
Type of bariatric surgery			Fisher's exact test	0.115
Lap band	3 (9%)	3 (5%)		
Gastric sleeve	21 (60%)	49 (78%)		
Gastric bypass	11 (31%)	10 (16%)		
BMI before surgery	45.6 (6.7)	41.4 (6.1)	9.8	0.002
BMI decrease	10.7 (4.1)	11.4 (4.5)	0.6	0.440
Time until follow-up (months)	14.7 (4.4)	11.6 (4.8)	10.0	<0.001

BMI body mass index, *M* [SD] means and standard deviations

The present study has three main aims:

1. To classify bariatric surgery patients by patterns of preoperative BED;
2. To compare these patterns between Israel and the United States;
3. To test for the effect of these patterns on surgery outcomes, both psychological and physical, and its difference between cultures.

Materials and methods

Study design procedure and ethics

This longitudinal study was carried out in the United States and Israel between 2015 and 2017 and collected psychosocial data from preoperative and postoperative bariatric surgery patients. The study received the approval of the IRBs of the university-based bariatric centers in both the United States ([Mary Imogene Bassett Hospital IRB NY (Project #1074)] Original approval date 07.01.2015) and Israel ([The Tel-Aviv Sourasky Medical Center (0511-13 TLV) Original approval date 27.01.15).

In the United States, patients were identified as eligible for the study after being approved for surgery by the bariatric surgery team. The study nurse, who interviewed the patients for study inclusion, obtained informed consent and verified completion of the questionnaire prior to surgery. After surgery, a research assistant either administered the study questionnaires at a scheduled clinic visit or mailed the follow-up questionnaires to the patient's home with a prepaid return envelope at 6, 12, and 18 months post-operatively (mean time = 14.7 months, SD = 4.4). Weight measurements were taken from the patients' medical records, and we chose the

follow-up weight measurement that was closest to the time in which the questionnaire was completed.

In Israel, each participant completed a self-report questionnaire, one week prior to surgery, at their preoperative assessment. After surgery, a research assistant contacted patients by telephone or mail (mean time = 11.6 months, SD = 4.8, range = 3–23) to complete their self-report questionnaires and self-reported weights.

Participants

Of the 81 participants in the US preoperative study, 36 were included in the postoperative assessment. One participant was further excluded due to missing data in at least one of the key variables. The majority of patients were women (83%) and the mean age was 46.4 (SD = 10.2, range = 26–66). Demographic and medical characteristics of the cohort are presented in Table 1.

Of the 169 participants in the Israeli preoperative study, 73 were included in the postoperative assessment. Ten participants were further excluded due to missing data in at least one of the key variables. The majority of patients were women (65%) and the mean age was 44.6 (SD = 12.1, range 22–71). Demographic and medical characteristics of this cohort are also presented in Table 1.

Measures

Body shape questionnaire-8C (BSQ-8C) [37]¹

The BSQ-8C is an 8-item questionnaire designed to evaluate participants' dissatisfaction with their body shape. Each

¹ The original English version of these questionnaires were translated into Hebrew in previous studies (for details see [22]).

item—e.g., Have you feared getting fat (or fatter)?—is rated on a 6-point scale ranging from 1 (never) to 6 (always), based on the individual's emotional state during the previous 4 weeks. The total score is the sum of the 8 items, ranging from 8 to 48, and higher scores indicate higher levels of distress about body shape. Internal consistency of the measure in the current study was satisfactory (Cronbach's alpha Israel = 0.82; United States = 0.77).

Emotional eating scale (EES) [38]²

The EES is a 25-item scale designed to assess the tendency of individuals to eat in response to negative emotional stimuli—e.g., “furious,” “lonely,”—with three subscales of anger/frustration, anxiety, and depression and a total score. Each item is rated on a 5-point scale, ranging from 1 (no desire to eat) to 5 (overwhelming urge to eat). The total score is the mean of the 25 items, ranging from 1 to 5, and higher scores indicate a greater urge to eat in response to negative mood states. Internal consistency of the EES total in the current study was satisfactory (Cronbach's alpha Israel = 0.95; United States = 0.95).

Suicidal behaviors questionnaire-revised (SBQ-R) [39]³

The SBQ-R is a brief 4-item self-report measure of suicidal thoughts and attempts: previous suicide attempts, frequency of suicidal ideation, previous suicidal communication, and subjective likelihood of a future suicide attempt. The total score is the sum of the items ranging from 3 to 18, and higher scores indicate increased risk of suicide. Internal consistency of the SBQ-R in the current study was satisfactory (Cronbach's alpha Israel = 0.76; United States = 0.71).

Patient health questionnaire (PHQ-9) [40]⁴

The PHQ-9 is a 9-item self-report screening tool and severity measure of depression. The component item scores range from 0 (not at all) to 3 (nearly every day). The column scores are added together to obtain a global score, which ranges from 0 to 27, and higher scores indicate higher levels of depression. Internal consistency of the PHQ-9 in the current study was satisfactory (Cronbach's alpha Israel = 0.85; United States = 0.86).

Generalized anxiety disorder 7-item scale (GAD-7) [41]

The GAD-7 is a 7-item self-report screening tool and severity measure of generalized anxiety—panic disorder, social anxiety disorder, and post-traumatic stress disorder—on a 4-point scale, ranging from 0 (not at all) to 3 (nearly every day). The scores are added to produce a total anxiety score ranging from 0 to 21, and higher scores indicate higher levels of anxiety. Internal consistency of the GAD-7 in the current study was satisfactory (Cronbach's alpha Israel = 0.79; United States = 0.84).

Demographic information

Participants were asked to report basic demographic information including gender, age, height, weight, and education. Body mass index was calculated as weight in kilograms divided by the square of height in meters (kg/m^2). Percent excess weight loss (%EWL) was calculated by assuming normalized body weight with a BMI of 25 kg m^{-2} ; change in BMI divided by pre-operative BMI-25 = % BMI loss [42].

Data analysis

Sample demographics are presented as means and standard deviations ($m \pm \text{SD}$) or counts and percentages. A Chi-Square test or one-way ANOVA was used to compare the demographic characteristics of the two cultures. *K*-means clustering procedure was used to identify clusters, and two-way MANOVA was used to compare cultures and clusters. Additional comparisons were conducted using the non-parametric Mann–Whitney test to confirm these findings, due to the small sample size.

Results

Preliminary analysis

As explained above, 73 patients in Israel and 35 in the United States consented to be included in the follow-up phase. Table 1 presents the demographic and medical statistics of all the participants in the follow-up study.

Clustering

K-means clustering procedure was used to classify bariatric surgery patients by preoperative BED composed of BID and emotional eating. We first tested a two-cluster model (39 and 59 participants). A three-cluster model resulted in one of the clusters including a small number of participants, therefore, we decided to use the two-cluster partitioning. The resulting two clusters differed in both BID and emotional eating, as

² The original English version of these questionnaires were translated into Hebrew in previous studies (for details see [22]).

³ The original English version of these questionnaires were translated into Hebrew in previous studies (for details see [22]).

⁴ We used the validated Hebrew versions of both PHQ-9 [43] and GAD-7 [44].

Table 2 Cluster characteristics of preoperative measures (data presented as *M* [*SD*])

	High BED cluster	Low BED cluster	<i>F</i> (1, 96)	<i>p</i>
BID	35.3 (5.5)	18.2 (5.3)	239.3	<0.001
Emotional eating	2.3 (0.9)	1.9 (0.7)	9.0	0.003

M[*SD*] means and standard deviations, *BID* body image dissatisfaction, *BED* body-related emotional distress

presented in Table 2. It can be seen that one cluster is characterized by higher levels of emotional eating and body image dissatisfaction than the other. The first cluster is henceforth described as high BED and the second cluster as low BED. High and low are relative to our specific sample and not to any cut-off point known for the entire population.

Comparing cultures

A Chi-square test was used to test for differences in cluster assignment between the United States and Israel. We found a tendency toward the difference between the cultures, with 51% (*N*= 18) of the US sample and 33% (*n*= 21) of the Israeli sample assigned to the high BED cluster.

Comparing outcome variables between cluster and culture

We tested the effects of clusters, cultures, and the culture by cluster interaction on postoperative psychological outcomes (anxiety, depression, risk of suicide) and physiological outcomes (EWL). These results are presented in Table 3. Their essence was not changed when follow-up time, gender, or age were added as covariates in a different analysis.

For depression, we found no significant cluster, culture, or interaction effects. For anxiety, we found no significant cluster by culture interaction, indicating no substantial

differences between the cultures in the effect of BED on anxiety. We did, however, find a significant main effect of culture, showing that anxiety is higher in the United States than in Israel, and a significant main effect of BED, showing that anxiety is higher in the high BED than the low BED cluster. For the risk of suicide, we found a significant BED cluster by culture interaction, indicating that the effect of BED on the risk of suicide differs between the two cultures. Specifically, we found that in the US sample, the high BED cluster showed a greater risk of suicide than the low BED cluster; the Israeli sample demonstrated an opposite trend. Finally, EWL across all groups was positive, indicating that the surgery indeed resulted in weight loss and was, therefore, effective. We found a significant BED cluster by culture interaction, indicating that the effect of BED on EWL differs between the two cultures. Specifically, in the US sample, the high BED cluster showed lower EWL than the low BED cluster, while the Israeli sample demonstrated an opposite trend.

Figures 1 and 2 present the interactions affecting EWL and risk of suicide respectively.

Figure 1 shows that in the United States, the difference in EWL between the clusters is subtler, with a slightly higher weight loss in the low BED cluster; Israel shows the opposite trend, with a stronger effect. Figure 2 shows that in the United States, the high BED cluster has a higher risk of suicide; the Israeli sample shows a subtler difference and an opposite trend. We further used a non-parametric test to examine the main effects (differences between countries and between clusters) and the results followed the same pattern.

Discussion

This longitudinal study was designed to shed light on preoperative shared psychological features that may be associated with psychological distress following bariatric surgery. Specifically, it looked to explore the association between certain profiles of candidates based on

Table 3 Comparison of clusters of preoperative measures and cultures in outcome measures (data presented as *M* [*SD*])

	High BED cluster		Low BED cluster		Culture effect		Cluster effect		Culture × cluster effect	
	Israel	US	Israel	US	<i>F</i>	<i>p</i>	<i>F</i>	<i>p</i>	<i>F</i>	<i>p</i>
Depression	4.7 (6.7)	7.2 (6.4)	3.2 (4.0)	3.0 (2.1)	0.6	0.442	3.5	0.064	0.9	0.358
Anxiety	9.6 (3.7)	14.7 (4.7)	8.9 (3.0)	10.3 (2.8)	10.3	0.002	6.3	0.014	3.1	0.084
Risk of suicide	3.2 (0.8)	5.2 (3.2)	3.8 (1.5)	3.3 (0.5)	2.7	0.106	2.1	0.155	6.3	0.014
EWL	0.9 (0.3)	0.5 (0.2)	0.6 (0.2)	0.7 (0.3)	10.8	0.001	1.2	0.281	12.7	0.001

Significant results (*p*<0.05) marked in bold

EWL excess weight loss, *BED* body-related emotional distress, *M*[*SD*] means and standard deviations

Fig. 1 Cluster by country interaction affecting EWL. *EWL* excess weight loss; *BED* body emotional distress

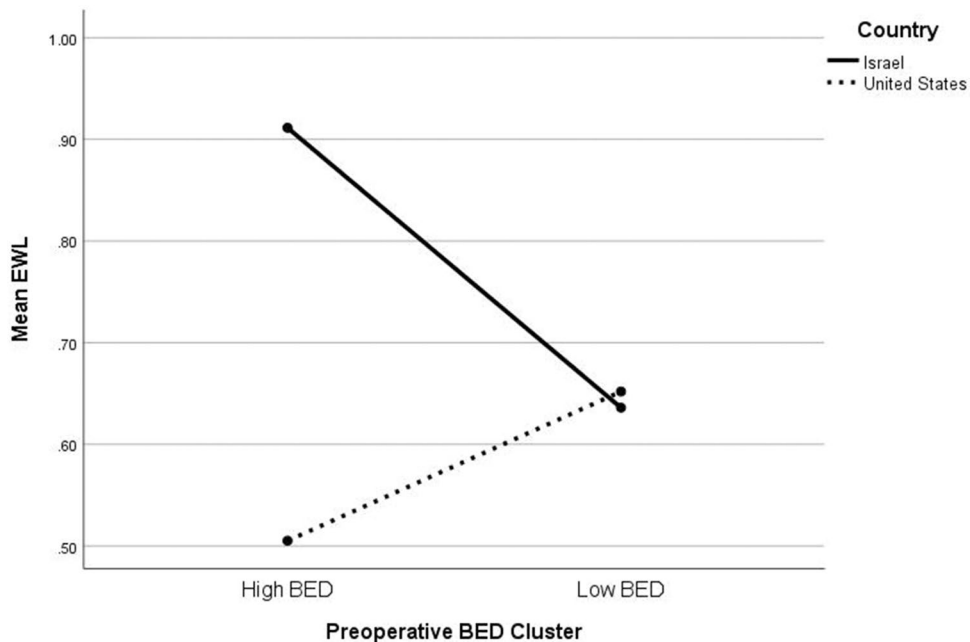
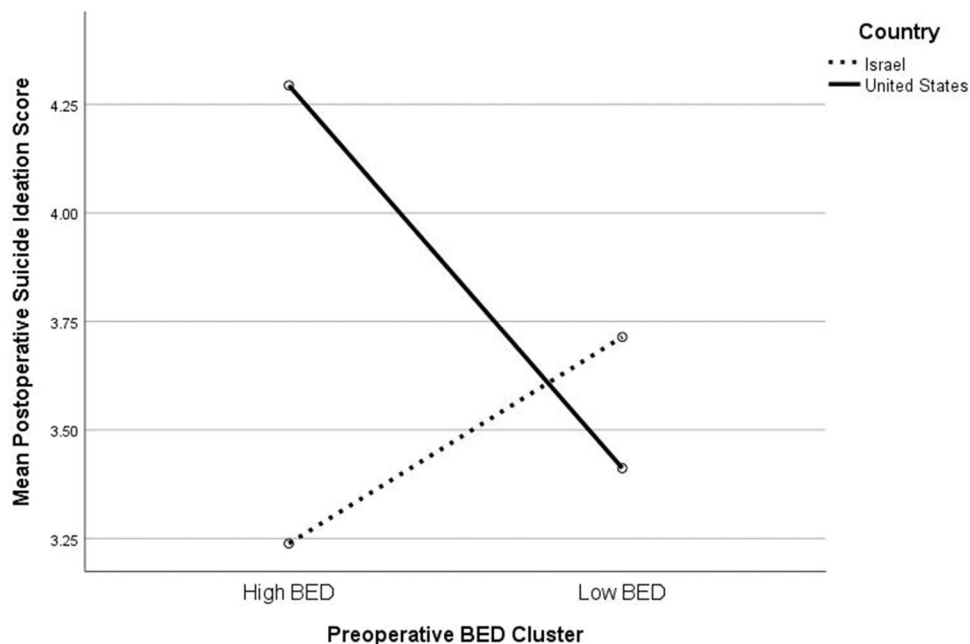


Fig. 2 Cluster by country interaction affecting the risk of suicide. *BED* body emotional distress



preoperative BED, as manifested in BID and emotional eating, and both physiological and psychological surgery outcomes.

The first main finding was that bariatric surgery patients may be classified by two distinct patterns of preoperative

BED: one cluster is characterized by high levels of emotional eating and BID and the other by low levels, representing higher and lower levels of BED. This finding emphasizes the role of BID and emotional eating depicted in the COD model, according to which both are needed to capture

stress-related components (e.g., weight bias internalization stigma) that affect psychological distress in bariatric surgery patients [13, 22, 23, 43].

A second important finding is that preoperative BED may have a postoperative effect; this, however, varies across cultures. Among the US patients, the high BED cluster portrays a higher risk of suicide and lower EWL following surgery, than the low BED cluster. In contrast, among the Israeli patients, the high BED cluster was related to a lower risk of suicide and higher EWL. Anxiety was generally found to be higher among US patients, although higher anxiety was found in the high BED cluster of both cultures. This corresponds with previous findings that link anxiety with BED [13, 16], thus affirming our measure of BED. It seems that none of the above findings are mediated by depression as there was no significant effect of cluster or culture on depression.

The reasons for this increased risk of suicide among US patients are not entirely known, but these results are consistent with previous data on the higher rates of postoperative suicide risk among US bariatric patients [44]. Two possible explanations may be cautiously suggested. First, the surgery outcomes were disappointing or failed to yield the expected improvements in quality of life [45]. Second, US culture is individualistic [35] and may thus provide less social support, which reduces patients' ability to cope with the drastic changes associated with bariatric surgery [45].

When approaching the results of the Israeli patients with high BED, it is worth noting that the Israel National Bariatric Surgery Registry [46] recently concluded that the numbers of bariatric surgery in Israel between 2014 and 2018 decreased. This unique phenomenon in the worldwide bariatric field may be partly explained by the regulation and standardization of preoperative assessment of bariatric patients in Israel by the Ministry of Health. While this has lengthened the preoperative assessment time and led to higher patient dropout [46], it has perhaps also limited bariatric surgery to determined patients who perceive the procedure as an act of choice [47] and thus have more realistic expectations. In addition, it can be speculated that Israeli culture, which is characterized by greater traditional, family-orientated closeness, provides patients with support and assistance in coping with the surgery and its outcomes [23].

A third finding is that while both cultures are quite similar in their EWL and risk of suicide when BED is low, the difference between cultures manifests itself when BED is high. It is possible that BED is a stronger risk factor in the United States than in Israel. Future research should be conducted to further explore the unique effect of preoperative BED as a risk factor for bariatric surgery outcomes in general and in each culture specifically. Targeting individuals from different cultural and sub-cultural backgrounds may enable a further

exploration of the differences and similarities across cultures. Other variables, such as weight-related stigma or perceived social pressure, may be related to the BED cluster or constitute another unique preoperative cluster. As prevention of suicide is a global health priority, it is necessary to identify novel predictors of suicide risk that can be recognized and mitigated in bariatric settings [48]. Physicians and other health professionals in the United States are encouraged to assess preoperative BED to identify and treat patients who are at risk of suicide following the surgery.

There is evidence that post-surgery improvement in psychological distress and quality of life is correlated with EWL improvements [49], although evidence also shows that these improvements may decline one-year post-surgery [50]. Our study contributes to the field by examining new shared preoperative predictors of psychological distress following surgery in a culturally diverse sample. Its longitudinal study design enables the assessment of the long-term effects of preoperative conditions, while its analytic approach combined multiple measures into a single index. However, the study has several limitations. First, the study design is cross-sectional, which limits the ability to infer causality. Second, since we have no records of non-respondents, we could not verify that either cohort was representative of the study population or that any refusal to respond was not related to the psychological distress measures. A large amount of missing data regarding anxiety requires the findings on this measure to be interpreted with caution. Third, there was evidence of dropout between the preoperative and postoperative evaluations in both cultures. This has been shown to be one of the major weaknesses of published studies on bariatric surgery, with follow-up rates after the first few months being lower than 50% [51] or even as low as 26.2% [52] in high-volume centers. We can, therefore, only speculate on the reasons why patients who underwent surgery failed to attend the follow-up activities. Finally, the timeline for completing the questionnaires differed somewhat between the Israeli and US participants; these differences were, however, minor enough not to affect the generalizability of the results regarding bariatric patients.

As the field of bariatric surgery grows, studies examining patients' preoperative psychological characteristics have great potential for improving patient selection, refining preoperative education, and developing intervention strategies to assist patients who may be at risk following the procedure.

What is already known on this subject?

Contemporary psychological theory contends that shared features across diagnoses, rather than a discrete diagnosis, better characterize psychopathology among postoperative bariatric surgery patients.

What this study adds?

Preoperative assessment of body-related emotional distress among bariatric surgery candidates may enable professionals to identify potential postoperative risks. The relationship between the body related emotional distress cluster and outcome measures is culture dependent.

Data availability The datasets generated and analyzed during the current study are not publicly available but are available from the corresponding author on reasonable request.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration.

Informed consent Informed consent was obtained from all individual participants included in this study.

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